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SOLAR HEATING AND COOLING
TECHNICAL DATA AND SYSTEMS ANALYSIS
PRESENTATION CHARTS

Center for Environmental and Energy Studies



**The University
Of Alabama
In Huntsville**

(NASA-CR-150012) SOLAR HEATING AND COOLING
TECHNICAL DATA AND SYSTEMS ANALYSIS Interim
Status Report, Sep. 1975 - Aug. 1976
(Alabama Univ., Huntsville.) 38 p HC \$4.00

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SEPTEMBER 1976



SOLAR HEATING AND COOLING
TECHNICAL DATA AND SYSTEMS ANALYSIS

PRESENTATION CHARTS
(Briefing to NASA September 20, 1976)

CONTRACT NAS8-31293

Submitted to

National Aeronautics & Space Administration
Marshall Space Flight Center, Alabama

(Summary for Period September 1975 - August 1976)



D. L. Christensen
Principal Investigator

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE
CENTER FOR ENVIRONMENTAL AND ENERGY STUDIES
HUNTSVILLE, ALABAMA

SEPTEMBER 1976

INTRODUCTION

This presentation was given to the NASA Marshall Space Flight Center on September 20, 1976 as part of an interim status report on Contract NAS8-31293. In addition, certain overall considerations concerning the contract effort were presented by UAH. These considerations included systems planning, methodology and procedures which might be applied to the current program. Projected activities including computer modeling, program management systems and other tasks involving the UAH Center for Environmental and Energy Studies were outlined at this time.

Attendees at the briefing were:

UAH Attendees

D. L. Christensen
E. A. Carter
J. P. Goddard
K. E. Johnson
W. L. Reid
B. J. Schroer
O. Tabor
L. A. Whinnery

NASA-MSFC Attendees

S. A. Hill
A. G. Kromis
R. L. Middleton
J. M. Price
O. L. Smith

**SOLAR HEATING AND COOLING
TECHNICAL DATA AND SYSTEMS ANALYSIS**

**RESEARCH STUDY FOR NASA-MSFC
CONTRACT NUMBER NAS8-31293
STARTING DATE - OCTOBER 1974**

**STATUS REPORT
THROUGH SEPTEMBER 20, 1976**

**THE UNIVERSITY OF ALABAMA IN HUNTSVILLE
CENTER FOR ENVIRONMENTAL AND ENERGY STUDIES**

PRESENTATION OUTLINE

INTRODUCTION AND OVERVIEW - OBJECTIVES, FINANCIAL, ETC.

TASK 1 - COMPUTERIZED DATA BASE (MIRADS)

TASK 2 - MANAGEMENT AND EDUCATIONAL MATERIALS

TASK 3 - SOLAR RADIATION INSTRUMENT CATALOG

TASK 4 - SOLAR RADIATION SITE DATA

TASK 5 - COMMERCIAL SITE TECHNICAL REVIEWS (ASHRAE)

OTHER TASKS

- SOLAR HEATING MODULE - DESIGN & SUPPORT
- AIA RESEARCH CORP. - TECHNICAL SUPPORT
- PROGRAM MANAGEMENT SUPPORT

SUMMARY

OVERALL PROGRAM OBJECTIVES

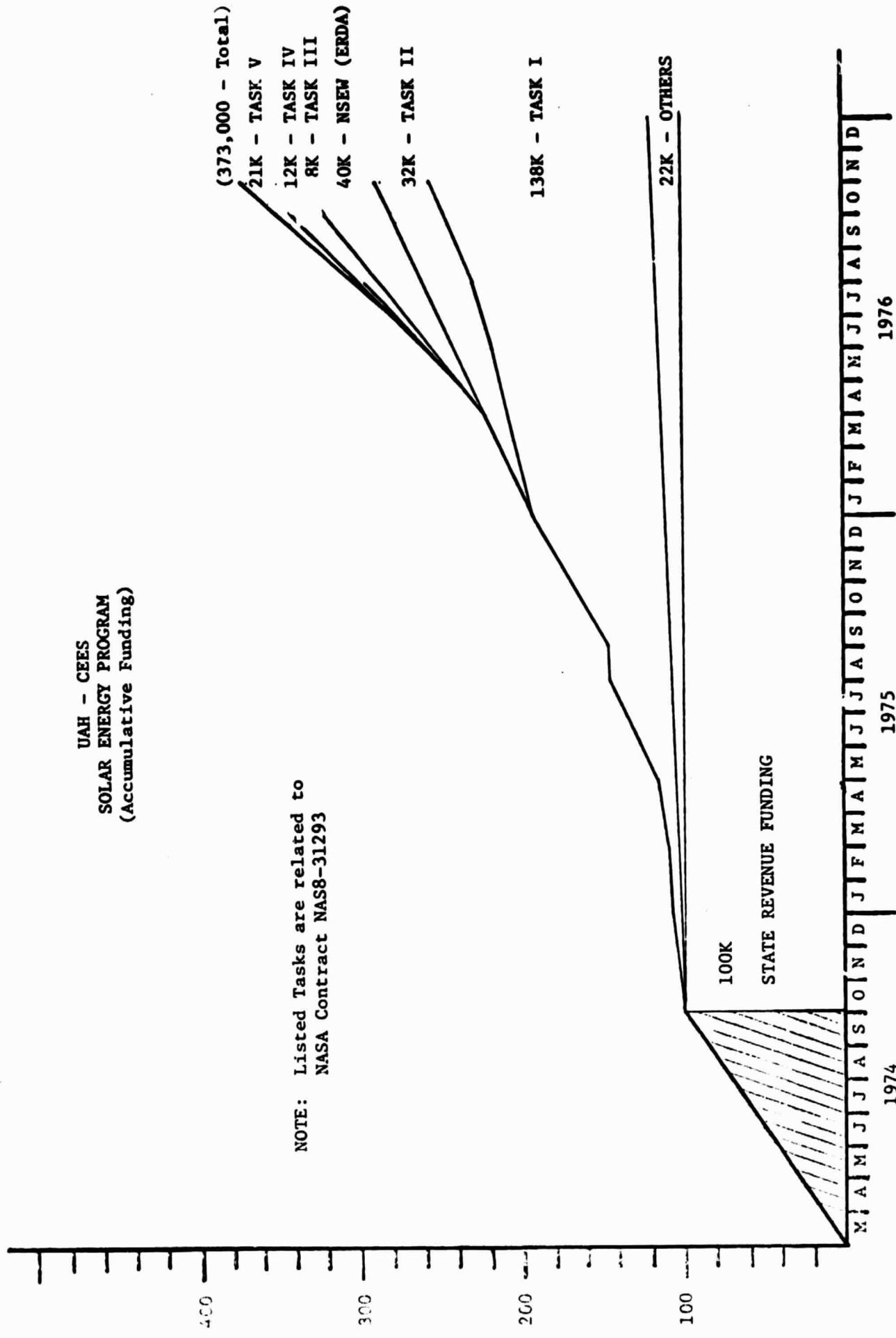
- PROVIDE RESEARCH SUPPORT TO MSFC SOLAR TASK TEAM
- DETERMINE STATE-OF-ART IN SOLAR ENERGY HEATING AND COOLING
- IDENTIFY SOURCES OF RELATED INFORMATION AND ACQUIRE NEEDED DATA
- DEVELOP DATA PACKAGES IN SELECTED AREAS
- PROVIDE FORMATS AND INPUTS FOR THE SYSTEMS ANALYSIS DATA BASE (NASA-MSFC)
 - ARCHITECTURAL
 - SITE CONDITIONS
 - MATERIALS
 - CLIMATIC
 - EQUIPMENT
 - ECONOMIC

CONTRACT ACTIVITIES

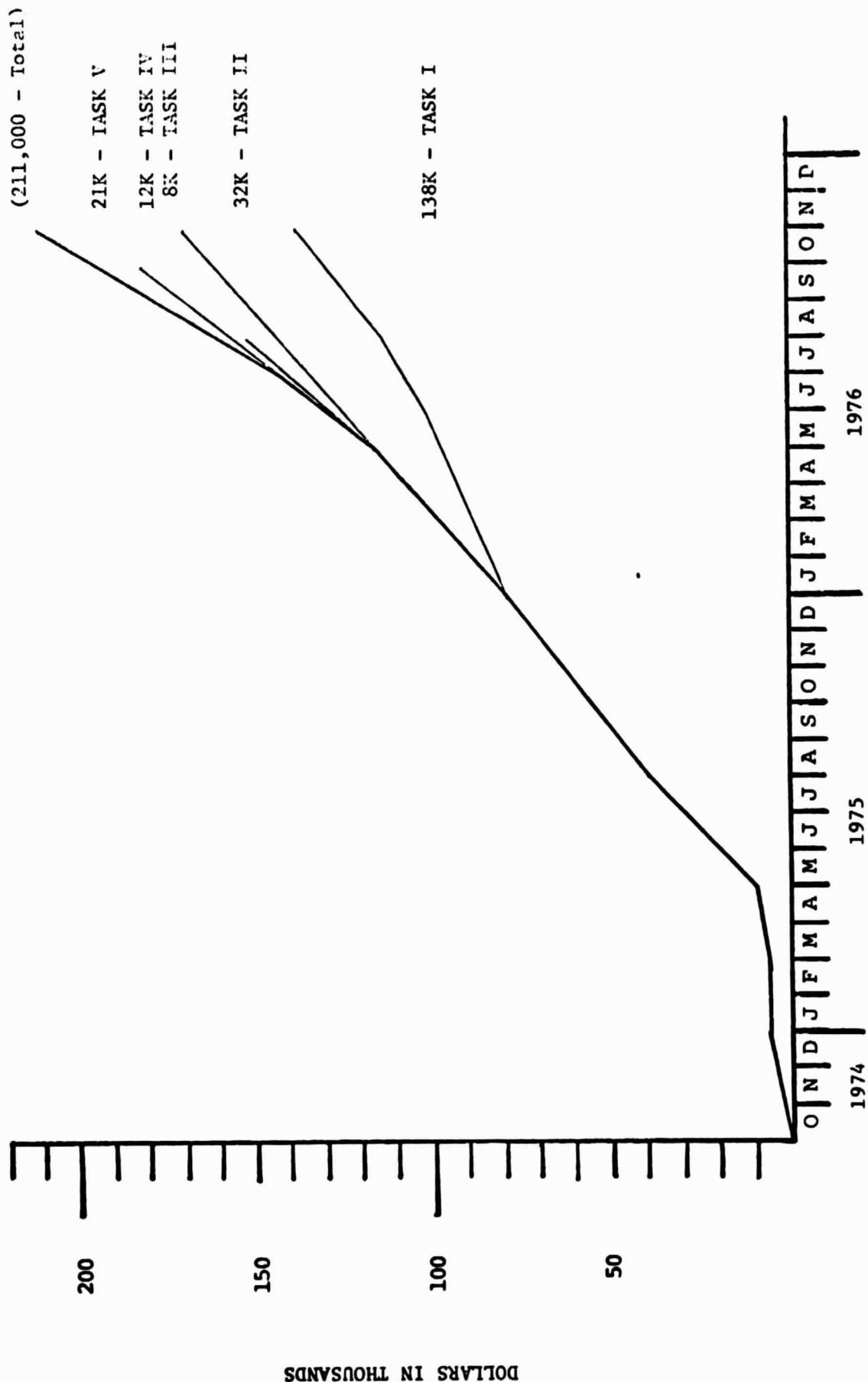
- DEVELOPED PRESENTATION MATERIAL (DATA PACKAGES, SLIDES, CHARTS, VISUALS)
- SEMINARS AND CONSULTANT SUPPORT (LÖF, DUFFIE, YELLOTT, ASHRAE)
- DEVELOPED BIBLIOGRAPHIES AND SOURCE MATERIALS
 - MATERIALS AND COATINGS
 - SOLAR WATER HEATERS
 - SYSTEMS ANALYSIS COMPUTER MODELS
- DEVELOPED AND UPDATED DETAILED MIRADS COMPUTER FORMATS FOR PRIMARY DATA PARAMETERS (NATIONWIDE) AND ENTERED DATA
 - CLIMATIC
 - ARCHITECTURAL
 - SITE (TOPOGRAPHY)
- IDENTIFIED AND CONTACTED DATA SOURCES IN EACH OF ABOVE AREAS
- IDENTIFIED AND CONTACTED SOLAR RADIATION DATA STATIONS AND INSTRUMENTS

**UAH - CEES
SOLAR ENERGY PROGRAM
(Accumulative Funding)**

NOTE: Listed Tasks are related to
NASA Contract NAS8-31293



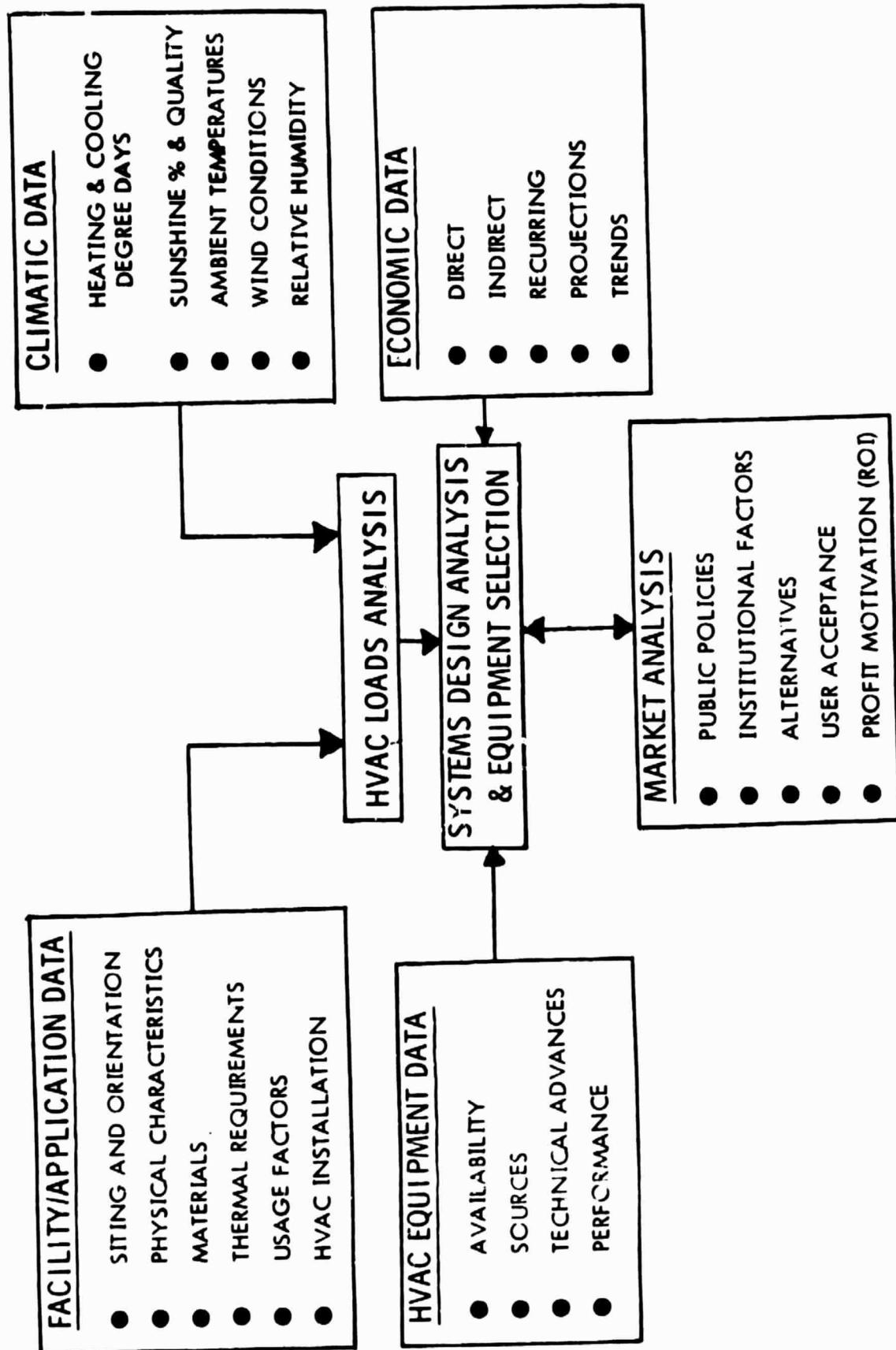
UAH - CEES
NASA MSFC CONTRACT NAS 8-31293
(Accumulative Funding)



TASK 1 OBJECTIVES

- COLLECT CLIMATIC AND ENVIRONMENTAL DATA FOR USE IN SIMULATIONS AND EVALUATIONS OF SHAC SYSTEMS
- ACQUIRE ARCHITECTURAL DATA TO DESCRIBE TYPICAL BUILDINGS FOR SYSTEMS ANALYSIS PURPOSES
- COLLECT DATA ON THE THERMAL PROPERTIES OF VARIOUS MATERIALS FOR THERMAL ANALYSES OF BUILDINGS
- ACQUIRE DATA ON CONVENTIONAL AND SHAC SYSTEMS AND COMPONENTS FOR PERFORMANCE EVALUATION
- ACQUIRE ECONOMICS DATA FOR SPECIFIC GEOGRAPHIC AREAS FOR ANALYSIS OF ECONOMIC INFLUENCES ON INPUT AND OPERATION OF SHAC SYSTEMS IN THE U.S.

DATA REQUIREMENTS

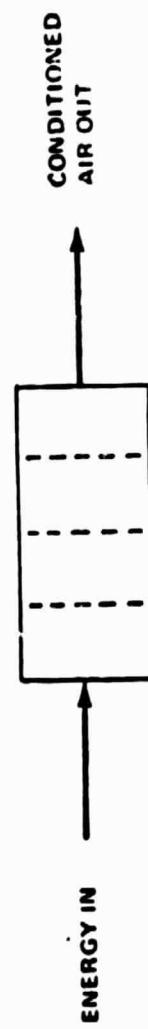


TASK 1 ACCOMPLISHMENTS

- 79 REELS OF SOLAR RADIATION AND WEATHER DATA HAVE BEEN COLLECTED,
AS WELL AS HARD COPY
- BLUEPRINTS OF "STANDARD" HOMES AND COMMERCIAL STRUCTURES HAVE BEEN
ACQUIRED FOR ANALYSIS
- A SURVEY OF ALL U.S. MANUFACTURERS OF CONVENTIONAL AND SHAC EQUIPMENT
HAS BEEN COMPLETED (CONTINUALLY REVIEWED AND UPDATED)
- DETAILED ECONOMIC DATA (1950 - 75) HAS BEEN GATHERED AND ENTERED INTO
THE NASA DATA BASE (PRIMARILY FROM STATISTICAL ABSTRACTS)
- A CARD CATALOGUE SYSTEM HAS BEEN DEVELOPED FOR ALL DATA SOURCES
- OVER 26,000 FORMAT SHEETS HAVE BEEN ENTERED INTO THE NASA DATA BASE
SINCE SEPTEMBER 1975.

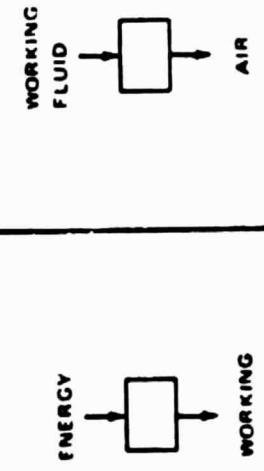
EQUIPMENT DATA BREAKDOWN

SYSTEM



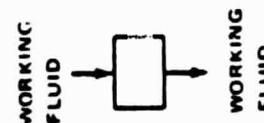
SUBSYSTEMS

HEAT EXCHANGER



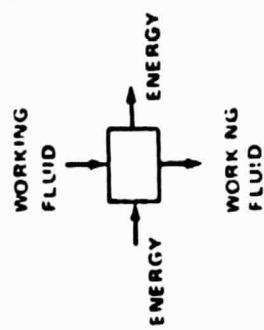
COMPONENTS
LIST

STORAGE



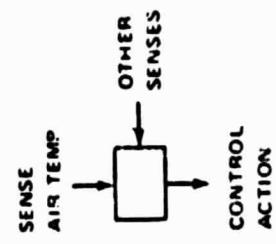
COMPONENTS
LIST

CHILLER



COMPONENTS
LIST

CONTROL

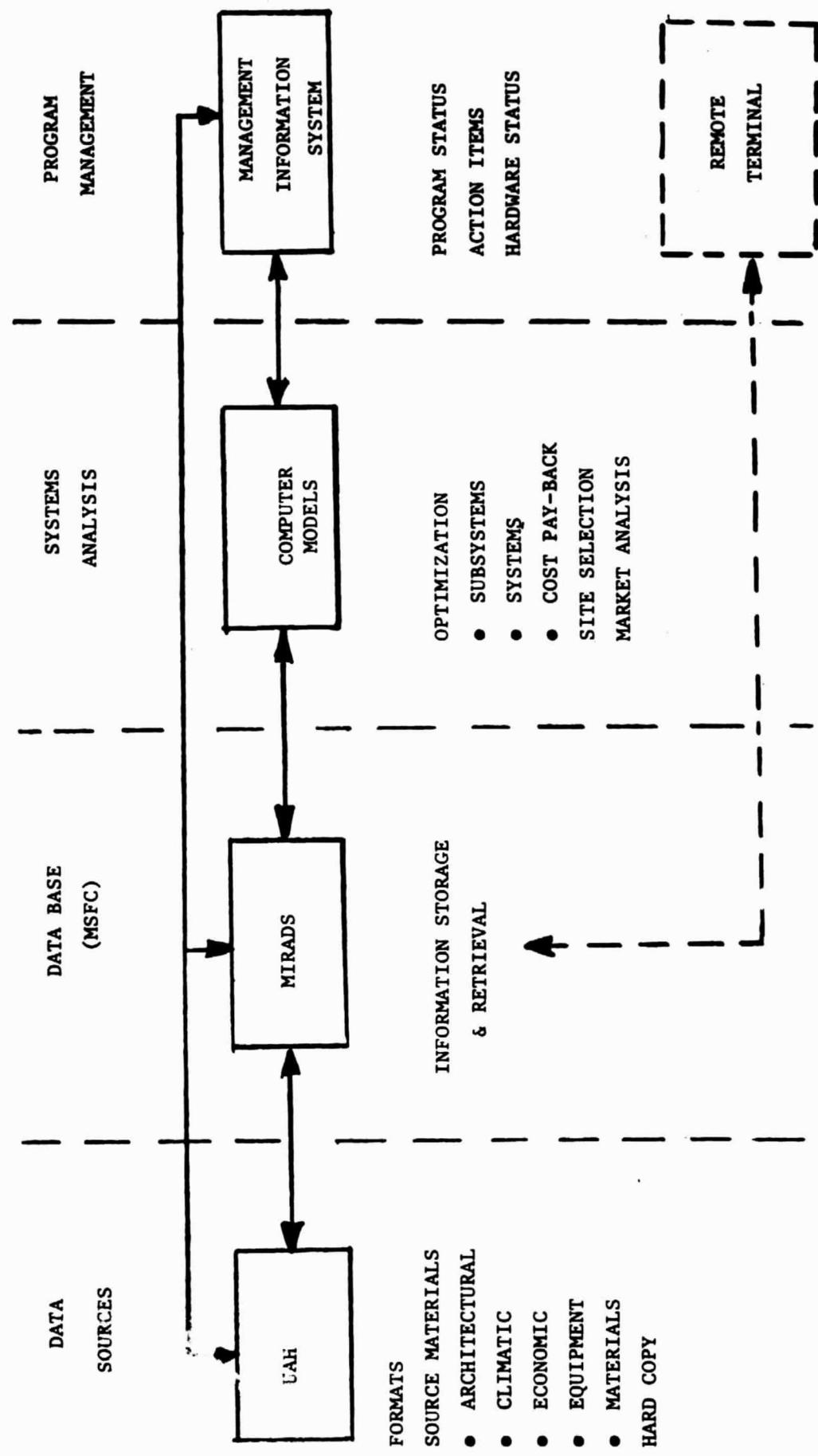


COMPONENTS
LIST

TASK 1 RECOMMENDATIONS

- COMPILE USER'S GUIDE TO DATA BASE (BROCHURE STYLE) TO ENCOURAGE BROADER AWARENESS AND UTILIZATION
- CARRY OUT USER SURVEY TO DETERMINE WHAT USERS NEED
- BASED ON ABOVE, PREPARE A PRIORITY LISTING OF PERTINENT PARAMETERS DESIRABLE FOR SHAC SYSTEMS ANALYSIS PROCEDURES
- LOCATE A REMOTE TERMINAL AT UAH FOR IMPROVED ACCESSIBILITY TO THE DATA BASE MATERIAL
- SURVEY ALL COMPUTER MODELS FOR UPDATING MIRADS
- SET UP COMPUTER FORMAT FOR ENTRY OF VARIOUS SOLAR PROJECTS NOW BEING COMPILED IN HARD COPY
- PUT RADIATION INSTRUMENTATION DATA FROM TASK 3 INTO THE EQUIPMENT LISTING
- SURVEY ALL SOLAR ACTIVITIES, STATE BY STATE, INCLUDING THE SITE ACTIVITY, ETC., FOR QUICK REVIEW OF REGIONAL ACTIVITY
- FORMAT SHAC MARKET PENETRATION PROJECTIONS FOR INCLUSION INTO DATA BASE
- COMPUTERIZE A LISTING OF DATA ACQUISITION SENSORS AND INSTRUMENTATION USING NASA INPUT

DATA FLOW DIAGRAM



TASK 2 OBJECTIVES

- DEVELOP TOTAL ENERGY SLIDE PACKAGE
- DEVELOP SOLAR ENERGY SLIDE DEPOSITORY AND CATALOG
- DEVELOP MSFC SOLAR ENERGY EFFORT SPEECH MODULES
- SET UP SOLAR ENERGY INFORMATION ROOM
- SURVEY MSFC SOLAR ENERGY CONTROL ROOM

TASK 2 ACCOMPLISHMENTS

- DEVELOPED TOTAL ENERGY SLIDE PACKAGE AND NARRATION
- CONTINUING TO UPDATE AND REFINE SOLAR ENERGY SLIDE DEPOSITORY AND CATALOG - 3 SETS
 - ADDING NEW SLIDES AS AVAILABLE
 - REPLACING OR PURGING OBSOLETE SLIDES
 - REFINING AND EXPANDING CATALOG
- CONTINUING SLIDE MODULES ON MSFC SOLAR ENERGY EFFORT
 - CAPTIONS AND BRIEF EXPLANATION OF SLIDES
 - ORGANIZE SLIDES INTO SUBJECT MATTER MODULES
- DEVELOPED SOLAR ENERGY INFORMATION ROOM
 - SLIDE VIEWERS DELIVERED
 - PACKAGES OF INFORMATION FOR REQUESTERS
- SURVEYED MSFC SOLAR ENERGY CONTROL ROOM AND PUBLISHED REPORT ON ANALYSIS AND RECOMMENDATIONS
- DEVELOPED AND DELIVERED SOLAR ENERGY WATER HEATING DEMONSTRATION UNIT - ON-GOING

TASK 2 RECOMMENDATIONS

- SURVEY MSFC TASK TEAM AND THEIR IDEAS AND NEEDS IN PUBLIC INFORMATION AND EDUCATION AREAS
 - REDIRECT SLIDE COLLECTION AND CATALOGING EFFORT TO SURVEY GUIDELINES
 - PURGE SLIDE DEPOSITORY BASED ON SURVEY GUIDELINES
 - DETERMINE DEMO UNITS NEEDED AND DEVELOP AS REQUIRED
- DEVELOP USER'S BROCHURE FOR SLIDE DEPOSITORY
- CONTINUE TO UPDATE, CAPTION, AND WRITE EXPLANATION OF EACH SLIDE
- DEVELOP TAILORED INFORMATION PACKAGES BY SUBJECT MATTER
 - SLIDES WITH BRIEF WORDS
 - MAILOUT PACKAGES
- CONTINUE TO DEVELOP IMPROVED SOLAR HOT WATER DEMONSTRATION UNITS

TASK 3 OBJECTIVES

- PREPARE LISTING OF ALL AVAILABLE SOLAR RADIATION MEASURING EQUIPMENT
- PREPARE TECHNICAL DATA SHEET FOR EQUIPMENT CHARACTERISTICS

TASK 3 ACCOMPLISHMENTS

- PREPARED PRELIMINARY EQUIPMENT LISTING FOR NATIONAL SOLAR ENERGY WORKSHOP
- CONTACTED EQUIPMENT MANUFACTURERS
- RECEIVED REPLIES FROM ALL 38 INQUIRIES
- TOTAL OF 141 INSTRUMENTS INCLUDED IN LISTING
- INCLUDED COST CODES, GLOSSARY, AND MATRIX IN REPORT

TASK 3 RECOMMENDATIONS

- COPIES BE DISTRIBUTED TO MANUFACTURERS AND DEALERS LISTED
- NEW FORMAT BE ADOPTED AS STANDARD TO DESCRIBE SOLAR RADIATION
MEASURING EQUIPMENT
- INCLUDE THIS INFORMATION IN THE TECHNICAL DATA BASE (TASK 1)

TASK 4 OBJECTIVES

- IDENTIFY SOLAR RADIATION DATA NOT ARCHIVED
BY THE NATIONAL WEATHER SERVICE
- COORDINATE WITH MSFC-ERDA-NOAA FOR A PLAN TO
EVALUATE AND USE THE DATA

TASK 4 ACCOMPLISHMENTS

- PRELIMINARY LIST OF NWS AND OTHER DATA
WAS PUBLISHED IN MAY 1976
- COORDINATION MEETING WITH ERDA-NOAA-MSFC-UAH
JULY 1976. REPORT INCLUDES PLAN FOR USE OF
SELECTED DATA.
- REVISED LIST OF NWS AND OTHER DATA PREPARED
FOR PUBLICATION SEPTEMBER 1976

TASK 4 RECOMMENDATIONS

- CONTINUE LISTING NEW SOLAR RADIATION DATA SOURCES
- WITH NOAA AND ERDA SELECT AND EVALUATE DATA FOR USE
IN SOLAR RADIATION PROJECTS
- PUBLISH USEFUL SOLAR RADIATION DATA
- INCORPORATE DATA INTO MSFC DATA BASE AS IT BECOMES
AVAILABLE (TASK 1)

TASK 5 OBJECTIVES

- COORDINATE SUBCONTRACT ACTIVITIES OF THE ASHRAE IN SUPPORT OF MSFC DESIGN REVIEW FOR COMMERCIAL DEMONSTRATION PROGRAM
- COORDINATION OF WORKSHOPS AND/OR SYMPOSIA FOR TECHNICAL INFORMATION TRANSFER
- PROVIDE SUPPORT FOR DEVELOPMENT OF TECHNICAL AND EDUCATIONAL MATERIALS (WORKSHOPS, SEMINARS, ETC.)

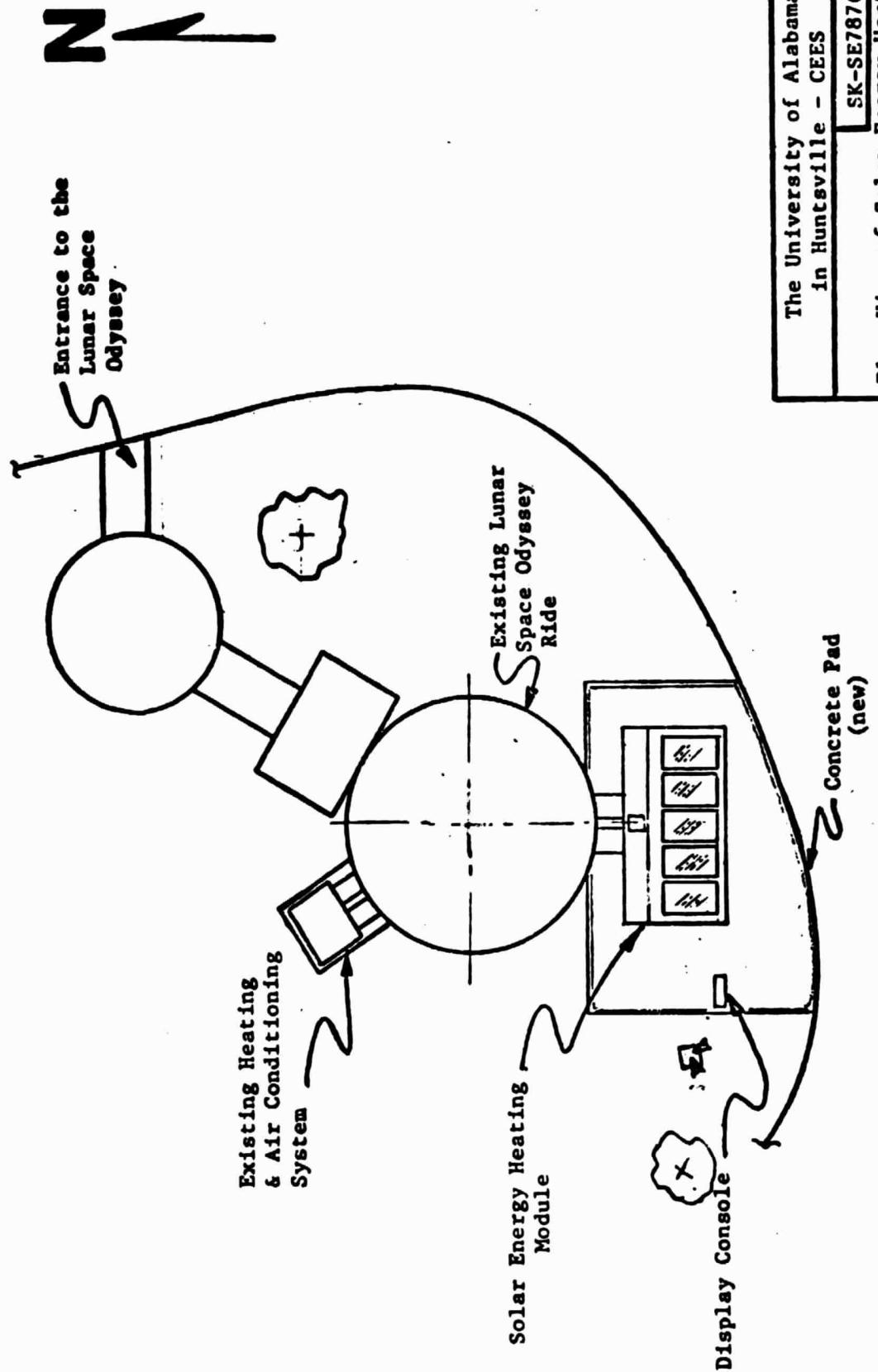
TASK 5 ACCOMPLISHMENTS

- DESIGN REVIEWS ACCOMPLISHED
 - ALABAMA POWER COMPANY
 - FRENCHMANS REEF MOTEL (VIRGIN ISLANDS)
 - REEDY CREEK UTILITIES DIVISION (DISNEY WORLD)
- COORDINATED MEETING ON 20 AUGUST BETWEEN ASHRAE,
UAH AND MSFC FOR DEVELOPMENT OF PROJECT EVALUATION
METHOD

TASK 5 RECOMMENDATIONS

- LONGER LEAD TIME FOR DESIGN REVIEW
EFFORTS PERFORMED BY ASHRAE
- CLOSER LIAISON BETWEEN UAH AND MSFC
- FORMALIZE UAH-ASHRAE EFFORT (TASK 5 EXPANSION)
FOR PROJECT EVALUATION METHOD

PROPOSED SITE FOR UAH SOLAR ENERGY HEATING MODULE



The University of Alabama
in Huntsville - CEES

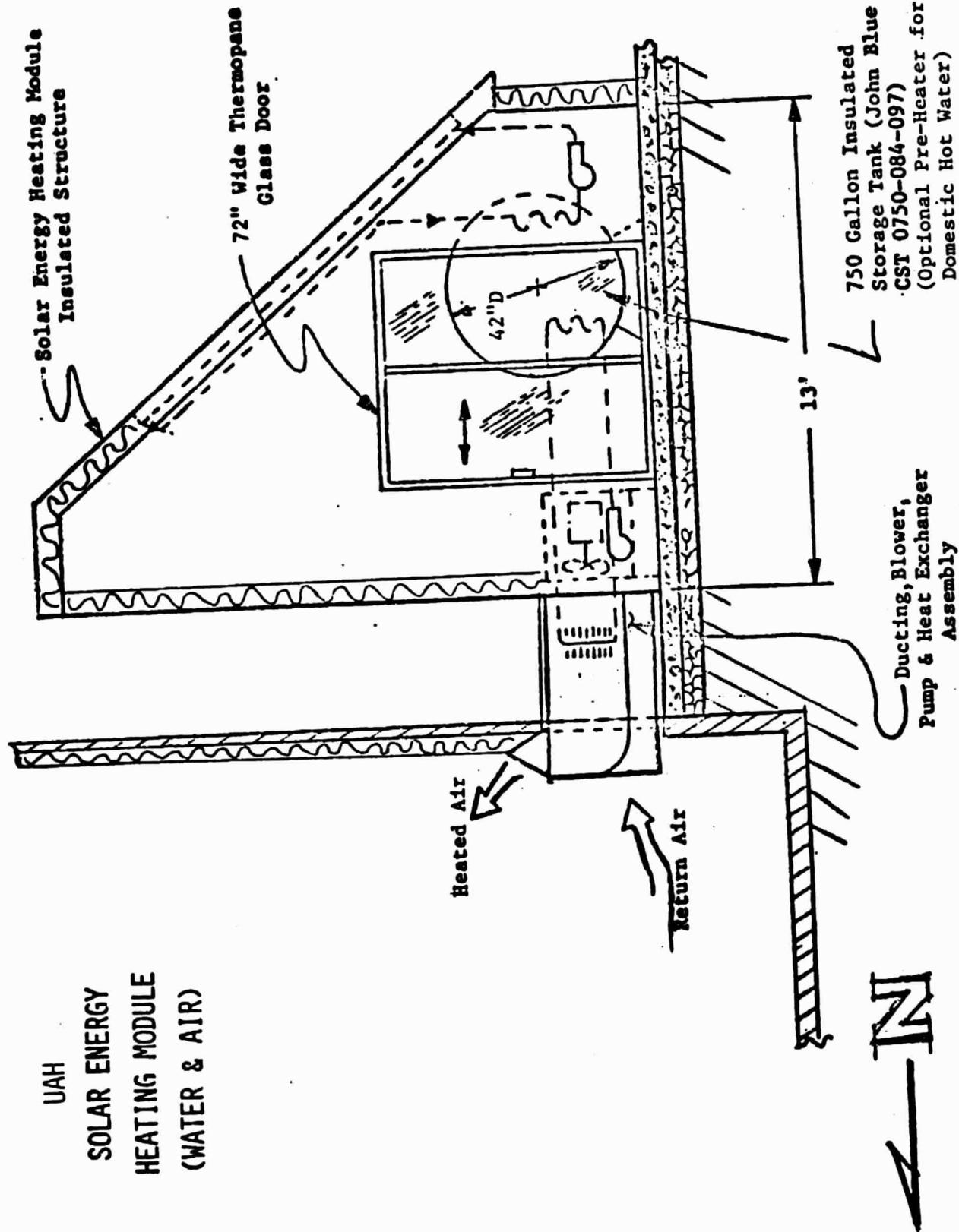
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Plan View of Solar Energy Heating Installation - Alabama Space 6

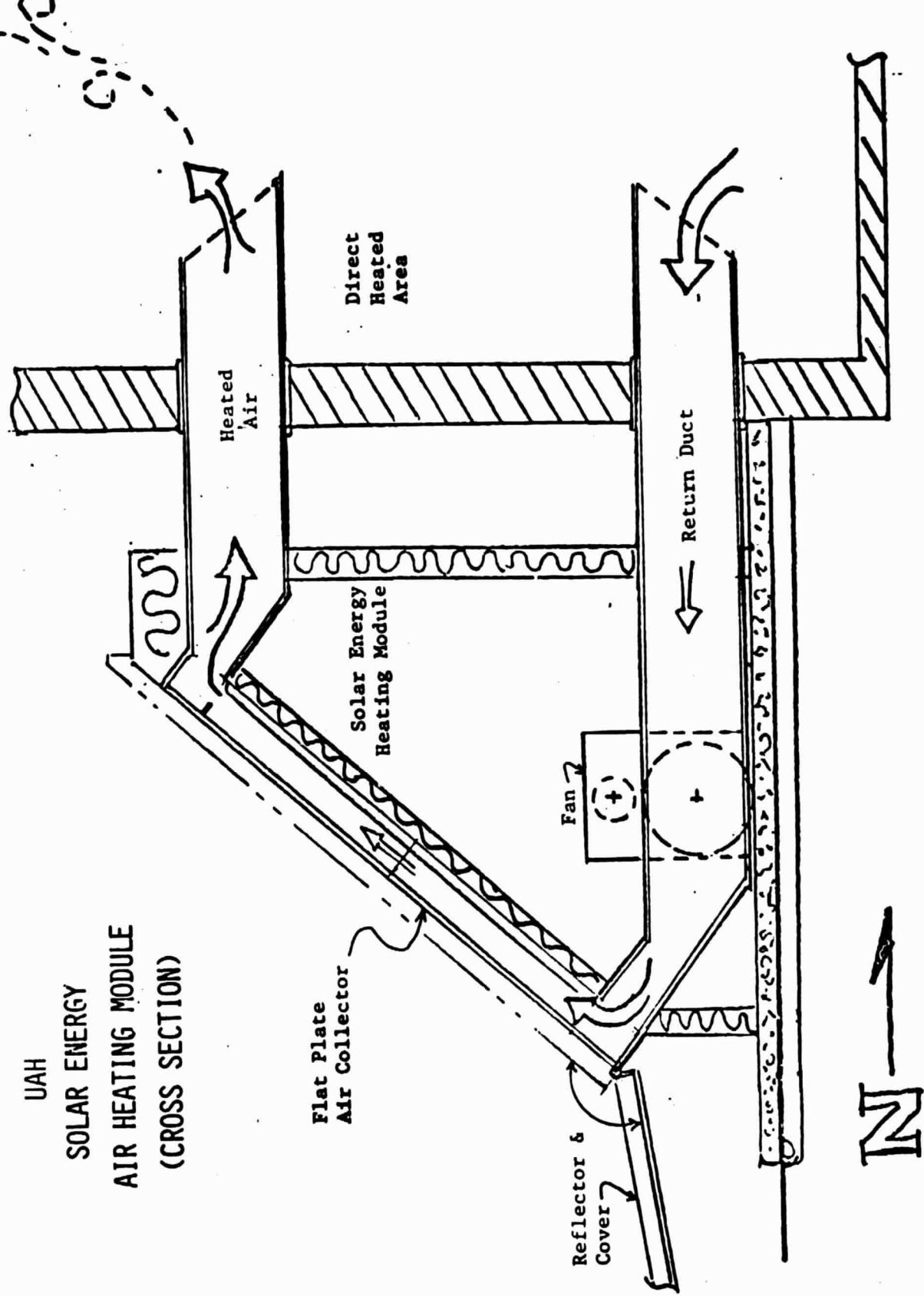
7/8/76
H. Steelman
Rocket Center

Appd: Dr. Christian Stassen

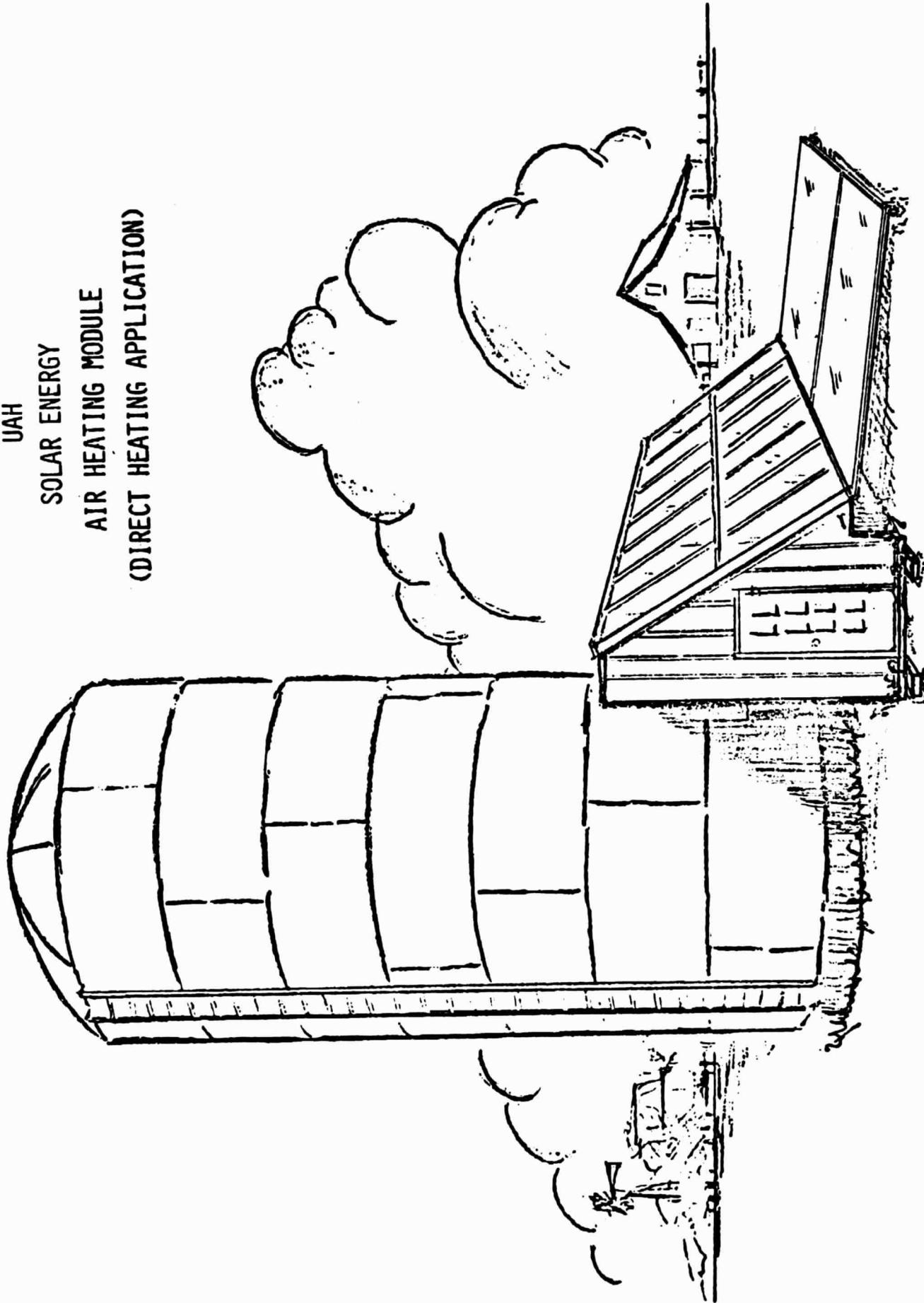
**UAH
SOLAR ENERGY
HEATING MODULE
(WATER & AIR)**



UAH
SOLAR ENERGY
AIR HEATING MODULE
(CROSS SECTION)



UAH
SOLAR ENERGY
AIR HEATING MODULE
(DIRECT HEATING APPLICATION)



USER REQUIREMENTS FOR DATA AND INFORMATION MANAGEMENT

USER REQUIREMENTS DEFINITION

CLASSIFICATIONS AND LOCATION

POTENTIAL INTERESTS AND NEEDS (SURVEY)

DATA VOLUME REQUIREMENTS

INTERFACE REQUIREMENTS

COSTS AND BENEFITS

ANALYTICAL TECHNIQUES

QUESTIONNAIRE DEVELOPMENT

USER CONTACTS

CATEGORIZATION

DATA SOURCES AND AVAILABILITY

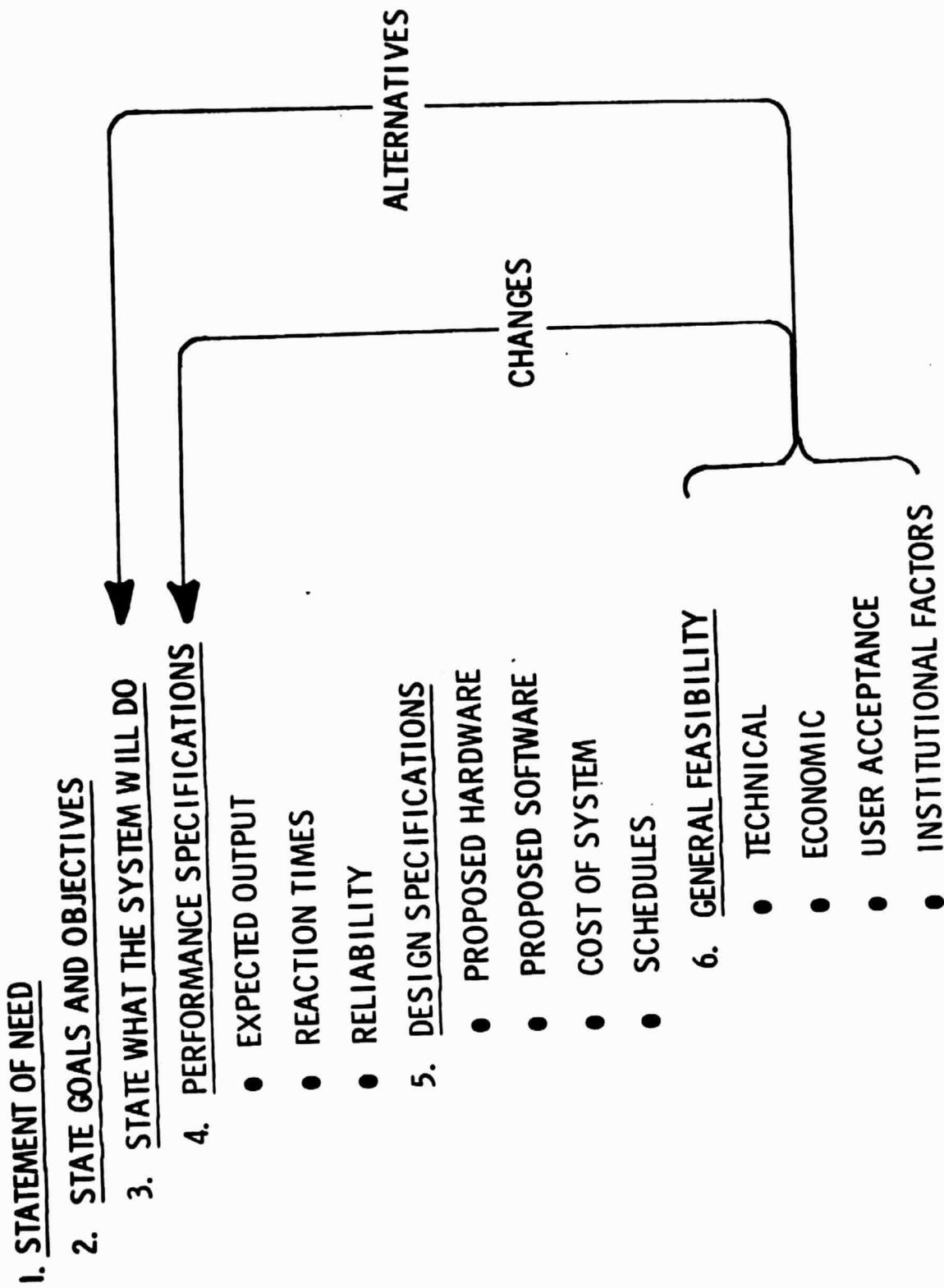
APPLICATION

COMPUTER DATA BASE

HARD COPY REQUIREMENTS

STORAGE AND RETRIEVAL TECHNIQUES

SYSTEMS DEVELOPMENT PROCEDURE



MANAGEMENT INFORMATION SYSTEM (MIS)
REQUIREMENTS

- RAPID DATA REDUCTION AND DISSEMINATION
- APPLICATION OF FUNDS AND EXPERTISE WHERE LOW RISK/HIGH RETURN RESEARCH WILL HAVE A LARGE EFFECT ON THE STATE-OF-THE-ART
- IDENTIFICATION OF PROGRAM MANAGEMENT NEEDS
- DEFINE OVERALL SYSTEMS CRITERIA
- STANDARDIZATION OF TERMS, FORMATS, DEFINITIONS, ETC.

MIS TASK-APPROACH

- REVIEW AVAILABLE SOLAR ENERGY PROGRAM MANAGEMENT PARAMETERS
- COMPILE DETAILED LIST OF ALL DATA REQUIRED TO MANAGE SOLAR ENERGY PROGRAMS
- DETERMINE APPLICATION OF DATA THAT CAN BE DISPLAYED, DISSEMINATED AND UTILIZED BY PROGRAM MANAGEMENT
- DETERMINE RELATIONSHIPS FOR USABLE DATA TO MEET PROGRAM MANAGEMENT OBJECTIVES:
 - SYSTEM FEASIBILITY DEMONSTRATION
 - DETERMINE AREAS WHERE PROGRAM WILL BE MOST EFFECTIVE IN MEETING DEMONSTRATION OBJECTIVES
 - IDENTIFY PROGRAM BENEFITS AND GIVE THEM VISIBILITY

MIS TASK-OUTPUT

- REVIEW AND RECOMMENDATIONS FOR MEETING PROGRAM MIS REQUIREMENTS
- A SET OF DEFINITIONS FOR QUALITATIVE TERMS
- SUGGESTED DATA REQUIREMENTS IN MATRIX FORM
- MATRIX FORMATS AND/OR COORDINATES FOR CURVES THAT CAN BE USED FOR DATA DISPLAYS
- SELECTION OF DATA THAT CAN BE USED TO RAPIDLY MEASURE PROGRESS AND EFFECTIVENESS OF THE PROGRAM
- PROGRAM IMPLEMENTATION PROCEDURES

SUMMARY

UAH NOW HEAVILY INVOLVED IN SOLAR ENERGY PROGRAM ACTIVITIES
IN SUPPORT OF MSFC:

- COMPUTERIZED DATA BASE (MIRADS)
- MANAGEMENT AND EDUCATIONAL MATERIALS DEVELOPMENT
- SOLAR RADIATION INSTRUMENT CATALOG & SITE DATA COLLECTION
- COMMERCIAL SITE TECHNICAL REVIEWS (ASHRAE)
- DESIGN, TECHNICAL AND MANAGEMENT SUPPORT